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10/789,947	02/27/2004	Deepika Srinivasan	24174-08750	5800

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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/789,947	Applicant(s) SRINIVASAN ET AL.	
	Examiner CHIKAODILI E. ANYIKIRE	Art Unit 2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11/24/2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16,20,22-53 and 57-79* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16,20,22-53 and 57-79* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. This application is responsive to application number (10789947) filed on February 27, 2004. Claims 1-16, 20, 22-53, and 57-79 are pending and have been examined.

Response to Arguments

2. Applicant's arguments with respect to claims 1-16, 20, 22-53, 57-79 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1-5, 7-9, 12-16, 22-32, 34-36, 39-45, 49-53, and 59-79 rejected under 35 U.S.C. 103(a) as being unpatentable over Biswas et al (US 7, 197, 074, hereafter

Biswas) in view of Chevance et al (US 6,473,462, Chevance) in further view of Pau et al (US 2002/0012396, hereafter Pau, hereafter Pau) (hereafter modified Biswas).

As per **claim 1**, Biswas a computer readable storage medium encoded with computer executable instructions for controlling a processor to perform a computer implemented method of determining a motion vector for encoding a block of a predicted video frame with respect to a reference video frame, the method comprising:

establishing a size for phase correlation blocks, the size of the phase correlation blocks being larger than the maximum allowable magnitude of the motion vector (column 3 lines 59 – 61; Biswas discloses the size of phase correlation blocks).

However, Biswas does not teach identifying a number of highest phase correlation peaks within an inner area of a phase correlation surface, the phase correlation surface based upon a phase correlation block of the predicted video frame and a corresponding phase correlation block of the reference video, the inner area having a size equal to or less than the maximum allowable magnitude of a motion vector;

determining for each phase correlation peak identified in the inner area, a motion vector.

In the same field of endeavor, Chevance teaches identifying a number of highest phase correlation peaks within an inner area of a phase correlation surface, the phase correlation surface based upon a phase correlation block of the predicted video frame and a corresponding phase correlation block of the reference video, the inner area

having a size equal to or less than the maximum allowable magnitude of a motion vector;

determining for each phase correlation peak identified in the inner area, a motion vector (column 2 lines 44 – 55; Chevance teaches using a mobile window within the frame in relation to the surface area based on the global motion vector, which would have the maximum allowable magnitude of a motion vector and in the window translational motion vectors are found within the window).

However, does not teach selecting from the determined motion vectors, a motion vector that has the minimum distortion measure between the block and a reference block offset from the block by the motion vector among the determined motion vectors.

In the same field of endeavor, Pau teaches selecting from the determined motion vectors, a motion vector that has the minimum distortion measure between the block and a reference block offset from the block by the motion vector among the determined motion vectors (paragraph [0042]; Pau teaches that determined motion vectors, candidate motion vectors, selects the candidate with the minimum SAD value in relation to motion estimation).

Therefore, it would be been obvious for one having skill in the art at the time of the invention to modify the invention to modify the invention of Biswas in view of Chevance in further view of Pau. Using the minimum SD value is a well-known practice in motion estimation and the advantage would be selecting the optimum motion vector for motion compensation. Chevance utilizes the window as a means for faster and more efficient tool for estimation translational motion vectors (column 2 lines 29 -31).

As per **claim 2**, Biswas et al disclose a computer implemented method of claim 1, wherein identifying at least one highest phase correlation peak between a phase correlation block of the predicted video frame and a corresponding phase correlation block of the reference video frame, comprises:

applying a Fourier transform to a phase correlation block of predicted video frame and a corresponding phase correlation block of the reference video frame (Fig 1, 104, Col 3 Ln 55-61 and Col 4 Ln 16-18);

determining a normalized cross product of the Fourier transforms (Fig 1, 108 and 110, Col 4 Ln 31-44);

determining an inverse Fourier transform to obtain a phase correlation surface (Fig 1, 112; Col 4 Ln 45-49); and

determining at least one peak on phase correlation surface (Col 4 Ln 49-52).

As per **claim 3**, Biswas et al disclose the computer implemented method of claim 1, wherein identifying at least one highest phase correlation peak, comprises:

determining for each peak a motion vector (Col 4 Ln 49-52);

selecting from the determined motion vectors, a motion vector that minimizes a distortion measure between the block and a block of the reference video frame offset from the block by the motion vector (Col 5 Ln 62 – Col 6 Ln 5 and Col 7 Ln 4-11).

As per **claim 4**, Biswas et al disclose the computer implemented method of claim 1, wherein selecting a motion vector, comprises:

applying each of the motion vectors to the block to obtain the reference block in the reference video frame (Col 5 Ln 14-19);

selecting the motion vector that minimizes a distortion measure between the block and the reference block (Col 5 Ln 62- Col 6 Ln 5 and Col 7 Ln 4-11).

As per **claim 5**, Biswas et al disclose the computer implemented method of claim 1, wherein each phase correlation block has horizontal and vertical dimensions that are a function of a maximum magnitude of the motion vectors (Col 4 Ln 19-24).

As per **claim 7**, Biswas et al disclose the computer implemented method of claim 1, further comprising:

applying to the phase correlation block of the predicted video frame a windowing function prior to determining the at least one phase correlation peak (Fig 1, 102; Col 3 Ln 45 – 54).

As per **claim 8**, Biswas et al disclose the computer implemented method of claim 7, wherein the windowing function reduces discontinuity between adjacent phase correlation block (Fig 1, 102, Col 3 Ln 45 – 54).

As per **claim 9**, Biswas et al disclose the computer implemented method of claim 7, wherein the windowing function is a smoothing function at the edges of the phase correlation block (Fig 1, 102, Col 3 45 – 54 and Col 3 Ln 65 – Col 4 Ln 2).

As per **claim 12**, Biswas et al disclose the computer implemented method of claim 1, wherein phase correlation blocks of the predicted frame are non-overlapping (Fig 5, Col 5 Ln 14 –38).

As per **claim 13**, Biswas et al disclose the computer implemented method of claim 1, wherein phase correlation blocks of the predicted frame are overlapping (Col 3 Ln 62 – Col 4 Ln 9).

As per **claim 14**, Biswas et al disclose the computer implemented method of claim 13, wherein the phase correlation blocks overlap by a minimum overlap value, where the minimum overlap value is greater than or equal to a maximum magnitude of the motion vectors (Col 3 Ln 62 – Col 4 Ln 9).

As per **claim 15**, Biswas et al disclose the computer implemented method of claim 13, wherein selecting from the motion vectors comprises selecting from the motion vectors associated with all phase correlation blocks that include the block (Col 5 Ln 62 – Col 6 Ln 5).

As per **claim 16**, Biswas et al disclose the computer implemented method of claim 1, wherein determining a number of phase correlation peaks comprises:

determining a fixed number of correlation peaks (Col 4 Ln 49-59).

As per **claim 22**, Biswas et al disclose the computer implemented method of claim 1, wherein selecting a motion vector comprises:

selecting a first motion vector which reduces the distortion measure below a threshold value (Col 5 Ln 46 – 50).

As per **claim 23**, Biswas et al disclose the computer implemented method of claim 22, wherein the threshold is a fixed distortion threshold (Col 5 Ln 46 – 50).

As per **claim 24**, Biswas et al disclose the computer implemented method of claim 22, wherein the threshold is an adaptive distortion threshold (Col 5 Ln 46 – 54).

As per **claim 25**, Biswas et al disclose the computer implemented method of claim 24, wherein the adaptive distortion threshold is a minimum distortion measure of a plurality of neighboring blocks (Col 5 Ln 46 – 54).

Regarding **claim 26**, arguments analogous to those presented for claim 1 are applicable for claim 26.

Regarding **claim 27**, arguments analogous to those presented for claim 1 are applicable for claim 27.

Regarding **claim 28**, arguments analogous to those presented for claim 1 is applicable to claim 28.

Regarding **claim 29**, arguments analogous to those presented for claim 2 is applicable to claim 29.

Regarding **claim 30**, arguments analogous to those presented for claim 3 is applicable to claim 30.

Regarding **claim 31**, arguments analogous to those presented for claim 4 is applicable to claim 31.

Regarding **claim 32**, arguments analogous to those presented for claim 5 is applicable to claim 32.

Regarding **claim 34**, arguments analogous to those presented for claim 7 is applicable to claim 34.

Regarding **claim 35**, arguments analogous to those presented for claim 8 is applicable to claim 35.

Regarding **claim 36**, arguments analogous to those presented for claim 9 is applicable to claim 36.

Regarding **claim 39**, arguments analogous to those presented for claim 12 is applicable to claim 39.

Regarding **claim 40**, arguments analogous to those presented for claim 13 is applicable to claim 40.

Regarding **claim 41**, arguments analogous to those presented for claim 14 is applicable to claim 41.

Regarding **claim 42**, arguments analogous to those presented for claim 15 is applicable to claim 42.

Regarding **claim 43**, arguments analogous to those presented for claim 16 is applicable to claim 43.

Regarding **claim 44**, arguments analogous to those presented for claim 17 is applicable to claim 44.

Regarding **claim 45**, arguments analogous to those presented for claim 18 is applicable to claim 45.

Regarding **claim 49**, arguments analogous to those presented for claim 22 is applicable to claim 49.

Regarding **claim 50**, arguments analogous to those presented for claim 23 is applicable to claim 50.

Regarding **claim 51**, arguments analogous to those presented for claim 24 is applicable to claim 51.

Regarding **claim 52**, arguments analogous to those presented for claim 25 is applicable to claim 52.

Regarding **claim 53**, arguments analogous to those presented for claim 1 is applicable to claim 53.

. Regarding **claim 59**, arguments analogous to those presented for claim 1 is applicable to claim 59.

Regarding **claim 60**, arguments analogous to those presented for claim 1 is applicable to claim 60.

Regarding **claim 61**, arguments analogous to those presented for claim 1 is applicable to claim 61.

As per **claim 62**, Biswas discloses the computer implemented method of claim 1, wherein the maximum allowable magnitude of the motion vector is based on an encoding parameter for controlling image quality (col 3 lns 62-64 and col 4 lns 58-67).

As per **claim 63**, Biswas discloses the computer implemented method of claim 1, wherein the number of identified phase correlation peaks increases as the size of the phase correlation block increases (col 3 lns 55-67).

As per **claim 64**, Biswas discloses the computer implemented method of claim 1, wherein the inner area of the phase correlation block is centrally positioned within the phase correlation block (col 3 lns 55-67).

Regarding **claim 65**, arguments analogous to those presented for claim 62 is applicable to claim 65.

Regarding **claim 66**, arguments analogous to those presented for claim 63 is applicable to claim 66.

Regarding **claim 67**, arguments analogous to those presented for claim 64 is applicable to claim 67.

Regarding **claim 68**, arguments analogous to those presented for claim 62 is applicable to claim 68.

Regarding **claim 69**, arguments analogous to those presented for claim 63 is applicable to claim 69.

Regarding **claim 70**, arguments analogous to those presented for claim 64 is applicable to claim 70.

Regarding **claim 71**, arguments analogous to those presented for claim 62 is applicable to claim 71.

Regarding **claim 72**, arguments analogous to those presented for claim 63 is applicable to claim 72.

Regarding **claim 73**, arguments analogous to those presented for claim 64 is applicable to claim 73.

Regarding **claim 74**, arguments analogous to those presented for claim 62 is applicable to claim 74.

Regarding **claim 75**, arguments analogous to those presented for claim 63 is applicable to claim 75.

Regarding **claim 76**, arguments analogous to those presented for claim 64 is applicable to claim 76.

Regarding **claim 77**, arguments analogous to those presented for claim 62 is applicable to claim 77.

Regarding **claim 78**, arguments analogous to those presented for claim 63 is applicable to claim 78.

Regarding **claim 79**, arguments analogous to those presented for claim 64 is applicable to claim 79.

6. Claims 6 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over modified Biswas in further view of Zhang et al (US 6, 449, 312).

As per **claim 6**, Biswas et al discloses the search window dimensions are integers of powers 2.

However, Biswas et al does not disclose the search window dimensions greater than 2S+16 in horizontal and vertical direction, respectively.

In the same field of endeavor, Zhang et al disclose motion estimation for a current macroblock (conventionally 16x16 pixels (Fig 1, image block 2; Col 2 Ln 37-40; Col 3 Ln 29-35)). Zhang et al further disclose that the search window of motion displacement can be as large as 128 pixels (Col 1 Ln 36-43; search windows are conventionally 32x32, 64x64, 128x128, etc., wherein all M and N are integers each a power of 2). Considering search window 4 in Fig 1 being a motion of 128x128, the maximum horizontal and vertical components of MV97) will be 32 pixels. The configuration meets the (i.e., S_h and S_v) relation N or M > $2S_h16$ or $2S_v+16$.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to modify the method of Biswas et al with the search window function of Zhang et al because a larger search areas will result in more accurate motion estimation and enhanced image quality.

Regarding **claim 33**, arguments analogous to those presented for claim 6 is applicable to claim 33.

7. Claims 10-11 and 37-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over modified Biswas in further view of Aude, Ario. “A Tutorial in Coherent and Windowed Sampling with A/D Converters”. February 1997.

As per **claim 10**, Biswas et al disclose the computer implemented method of claim 7.

However, Biswas et al does not explicitly each wherein the windowing function is an extended 2D cosine bell function.

In the same field of endeavor, Aude discloses wherein the windowing function is an extended 2D cosine bell function (page 7, Extended Cosine Bell).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to modify the method of Biswas et al with the window function of Aude. The advantage of window function is that it prevents leakage in a signal and performing 2D cosine bell windowing function is a well-known procedure conventionally implemented prior to Fourier Transformation.

As per **claim 11**, Biswas et al disclose the computer implemented method of claim 10.

However, Biswas et al disclose the windowing function is:

$$W(m,n) = \begin{cases} \frac{1}{2}\left[1-\cos\left(\frac{16*m*\Pi}{M}\right)\right]*\frac{1}{2}\left[1-\cos\left(\frac{16*n*\Pi}{N}\right)\right]...for\left(\frac{M}{16} \le m...or...m \ge \frac{15*M}{16}\right)and\left(\frac{N}{16} \le n. \right. \\ 1...otherwise. \end{cases}$$

where M is a width of a phase correlation block and N is a height of a phase correlation block.

In the same field of endeavor, Aude teaches the windowing function which is analogous to windowing function of claim 11:

$$A = \begin{Bmatrix} \frac{1}{2}\left[1-\cos\left(\frac{16*t*\Pi}{T}\right)\right]...for(t == 0...to...T/10...and...t = 9T/10...to...T); and \\ A = 1..for..t = T/10...to...9T/10. \end{Bmatrix}$$

where M is a width of a phase correlation block and N is a height of a phase correlation block (pg7, extended cosine bell selecting a denominator of 16 instead of 10 is an obvious option for image processing).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to consider an interval of 1/16 instead of 1/10 (conventional interval in image coding) to obtain:

$$W(m,n) = \begin{cases} \frac{1}{2}\left[1-\cos\left(\frac{16*m*\Pi}{M}\right)\right]*\frac{1}{2}\left[1-\cos\left(\frac{16*n*\Pi}{N}\right)\right]...for\left(\frac{M}{16} \le m...or...m \ge \frac{15*M}{16}\right)and\left(\frac{N}{16} \le n...or...n \ge \right. \\ 1...otherwise. \end{cases}$$

. The advantage of window function is that it prevents leakage in a signal and performing 2D cosine bell windowing function is a well-known procedure conventionally implemented prior to Fourier Transformation.

Regarding **claim 37**, arguments analogous to those presented for claim 10 is applicable to claim 37.

Regarding **claim 38**, arguments analogous to those presented for claim 11 is applicable to claim 38.

8. Claims 20, 46-48, 57 and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over modified Biswas in further view of Biswas et al. “A Novel Motion Estimation Algorithm Using Phase Plane Correlation for Frame Rate Conversion”. November 2002 (hereafter Biswas2).

As per **claim 20**, Biswas et al disclose the computer implemented method of claim 1.

However, Biswas et al does not teach wherein determining at least one phase correlation peak comprises interpolating subpixel peak values from the phase correlation peaks at pixel locations in the phase correlation block.

In the same field of endeavor, Biswas et al teach wherein determining at least one phase correlation peak comprises interpolating subpixel peak values from the phase correlation peaks at pixel locations in the phase correlation block (Section 4).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to modify the method of Biswas et al with the method of Biswas et al. The advantage is that it compensates for the speed of motion.

As per **claim 46**, Biswas et al disclose the apparatus of claim 1.

However, Biswas et al does not teach wherein determining at least one phase correlation peak comprises:

determining a number of correlation peaks as a function of a variance of the values of the values of the phase correlation peaks

In the same field of endeavor, Biswas et al teaches wherein determining at least one phase correlation peak comprises:

determining a number of correlation peaks as a function of a variance of the values of the values of the phase correlation peaks (Section 3).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to modify the method of Biswas et al with the method of Biswas et al. The advantage is that it compensates for the speed of motion.

Regarding **claim 47**, arguments analogous to those presented for claim 20 is applicable to claim 47.

Regarding **claim 48**, arguments analogous to those presented for claim 21 is applicable to claim 48.

Regarding **claim 57**, arguments analogous to those presented for claim 46 are applicable for claim 57.

Regarding **claim 58**, arguments analogous to those presented for claim 48 are applicable for claim 58.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHIKAODILI E. ANYIKIRE whose telephone number is (571)270-1445. The examiner can normally be reached on Monday to Friday, 7:30 am to 5 pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marsha D. Banks-Harold can be reached on (571) 272 - 7905. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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